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Effects of Combined Physiotherapy Hold Relax and Glucosamine to the Decrease of COMP through Pain reduction, Increase Muscle Strength and addition of Osteoarthritis of the Knee Joint ROM

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Abstract

The purpose of this study was to determine the effect of a combination of administration Hold Relax (HR) and glucosamine in reducing the levels of COMP through decreased pain, increased muscle strength, and the addition of Osteoarthritis **(**OA) of the knee joint ROM. This study is a quasi-experimental design with two groups of pre and posttest controlled group design, in which subjects were divided into two groups: Group 1 was given 3 times the treatment of HR within a day and glucosamine one capsule per day for 1 week and Group 2 was given 6 HR treatment time within a day and glucosamine once daily for 2 weeks. Measurements were performed before and after treatment for the time specified by the respective groups to determine the value of the Range of Motion (ROM), VAS, MMT and COMP levels (serum).These results indicate that there is a significant difference in pain reduction (95% confidence level) between the two groups in which the average reduction in pain was higher than Group 2 Group 1. Likewise with measurements of muscle strength showed that there were significant differences (level 95%) between the two groups in which the average increase in muscle strength higher than Group 2 Group 1.

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In the measurement result ROM, there is a significant (95% confidence level) between the two groups in which the average addition of ROM in Group 2 higher than group 1. Based on the value of COMP, there is a significant difference (95% confidence level) between the two groups in which the average reduction in the levels of COMP in Group 2 was higher than group 1. The result of Pearson correlation test showed that there is a significant correlation between the increase in ROM with a decrease in pain (r = 0.636 or 63.6%). There is also a significant correlation between increased ROM with decreased levels of COMP (r = 0573 or 57.3%). Likewise, there is a significant correlation between reduced levels of COMP with a decrease in pain (r = 0402 or 40.2%). From these results it can be concluded that the combination of physiotherapy HR and glucosamine is effective in towards decreased levels of COMP through decreased pain, increased muscle strength, increase ROM at osteoarthritis knee joint, where the provision of physiotherapy HR 6 times within a day and glucosamine once per day in two weeks more effective than the combination of HR administration physiotherapy 3 times within a day and glucosamine once per day in one week.

***Keywords**:* Osteoarthritis; knee pain; limited ROM; muscle weakness; SCOMP levels; physiotherapy hold relax; glucosamine.

1. Introduction

A degenerative disease of the joints and potentially reduce the ability of motion and function of gestures is Osteroarthritis (OA) are usually preceded by the occurrence of an injury to the cartilage [1]. Preceded by clinical symptoms of OA cartilage degradation, clinically generally in the form of pain, weakness and contractures muscle / tendon and joint stiffness in the form of a decrease in Range Of Motion (ROM) that can eventually lead to disability joints. It is estimated that as many as 80% of patients have limited range of motion, while 25% of patients are depressed and isolate themselves [2].

Although the major abnormalities in OA is damage to the integrity of joint cartilage, but actually OA is a joint disease overall (whole joint disease) with damage to all parts of the joints as the synovial tissue, bone and cartilage, wrapping joints, connective tissue of the joints and muscles and tendons around the joints, which are involved in the pathological process causes joint degeneration [3,4]. Each joint can have OA, but most often is the knee joint [5]. The incidence of knee OA, based on population studies in the US, which is comparable to that in Europe. These studies report that severe radiological changes affecting 1% of those aged 25-34, and this figure rose to nearly 50% in those aged 75 years and above. Among the samples were aged over 45 years in the Framingham Study, the prevalence of radiological knee OA was 19.2%, and in those aged over 80 years, the figure rose to 43.7%. According to data from the Dutch Institute for Public Health, the prevalence of OA of the knee in those aged 55 years and over was 15.6% in men and 30.5% in women [6]. In Indonesia, OA classified as joint disease / arthritis are based on Basic Health Research conducted by the Center for Health Research and Development in 2013 found prevalence of OA of 24.7% [7]. OA of the knee joint is the whole joint disease that damages joints all components of the degradation of collagen type 2 resulted in synovitis capsule, resulting in pain around the joints. Further as a result, there will be components of the joint capsule contracture, tendon and

hamstring muscles, gatstrocnemius and quadriceps, joint stiffness and decreased ROM, as well as the weakness of the muscles around the knee joint that can eventually lead to disability [8]. During this time, a conservative approach to deal with the symptoms of OA, especially pain, is to use a group of NSAID drugs that aim to inhibit the pain response in areas experiencing OA. Use of the drug is quite effective in dealing with pain, but it is temporary and cannot overcome the problems of biomechanics such as joint stiffness and decreased ROM, contracture capsule, tendons and muscles, as well as muscle weakness, in addition to having adverse side effects the patient, the digestive system disorders, like lesions in the colon [9], [10].Research-related research efforts to improve motor function have been widely performed, among others [11] of the 33 samples of patients with OA were handled manually and exercise therapy for 8 weeks found an improvement of 55.8% ($P < 0.05$), while in the control group, which consisted of 36 people, treated with ultrasound therapy for 8 weeks only an improvement of 14.6% ($P < 0.05$). A similar study conducted by Aras [12] of the 31 samples of patients with impaired function of the cervical (dysfunction / cervical stiffness) which is handled by contract ROM relax found an increase in the average 83.71% lateral flexion, rotation 103.42%, and 72.79 % flexion-extension after handled for 6 weeks ($P < 0.05$).

To overcome the problems mentioned above, the chosen one acts physiotherapy Hold Relax (HR), because HR is an act of exercise special physiotherapy that has component moves in the form of active movement, passive, isometric resisted static contraction, relax passive movement, traction and forced passive movement. Hold relax begins with active and passive movement either toward agonist or antagonist which is reciprokal movement innervation (reciprokal fascilitation and reciprokal inhibition) with the aim to reduce the pain. Then proceed with Isometric resisted static contraction of agonist and antagonist which aims to reduce the pain, playing the antagonist and agonist muscle fibers and muscle strengthening. Furthermore, the passive motion movement relax agonists and antagonists accompanied by palpation in the form of friction in areas experiencing pain aims to relieve pain. After that, given the traction on the knee joints with the aim of increasing intra-articular space in order to avoid friction at the time of the end joints of forced passive movement. Lastly, do forced passive movement toward agonist component aims to extend the tendons, muscles and capsule contracture resulting in the addition of passive ROM of the knee joint [13]. The latest development management of OA is to use drugs that contain glucosamine. Glucosamine is the base material forming glycosaminoglycans (GAGs), which is widely available in the synovial fluid form of hyaluronic acid (HA). Administration of glucosamine is intended to stimulate the production of joint fluid, and can also help in nutrition and lubrication of joints, thereby reducing friction and abrasion collagen in joints when performing HR end. Until now, research on the effects of physiotherapy techniques HR administration of glucosamine plus the decline COMP through decreased pain, increased muscle strength, and the addition of OA of the knee joint ROM, to our knowledge has never been done. Therefore, we are interested in doing research on this effect.

2. Materials and Methods

This study is a quasi-experimental design with two-group pre and posttest controlled group design. A total of 40 patients who came for treatment at the Clinic Physio Way and Medisakti with knee OA diagnosis based on radiological examination (KL and KL-III-IV) and clinical symptoms included in the study. Patients who are undergoing treatment other than physiotherapy and taking anti-pain medications or have arthritis of other joints,

such as RA, excluded from the study. Fortieth of the subjects were randomly divided into two groups with the same number, which is 20 people per group. Group 1 was given 3 times a day treatment interval HR and glucosamine once per day for one week, while the second group was given 6 times a day treatment interval HR and glucosamine once per day for 2 weeks.

Table 1: General Characteristics of Research Sample

Stattistic	Group 3x treatment HR		Group 6x treatment HR	
	Frequence	Percentage	Frequence	Percentage
Age				
Average	59,8 years	-	60,25 years	-
Minimal	42 years	-	57 years	-
Maksimal	73 years	-	90 years	-
Sex				
Male	5 persons	25%	6 persons	30%
Female	15 persons	75%	14 persons	70%
KL level				
3	14 persons	70%	17 persons	85%
4	6 persons	30%	3 persons	15%
Body weigh				
Average	72,3 kg	-	73,35 kg	-
Minimal	55 kg	-	57 kg	-
Maksimal	90 kg	-	90 kg	-
a.				
Total Samples	20 persons	100%	20 persons	100%

Procedures for implementing HR is 1) in the prone position, the patient is asked to perform active movements of flexion knee until it reaches the limit ROM, 2) the patient is asked to perform the movement of knee extension and physiotherapists provide custody, causing isometric contraction in the extensor muscles of the knee, 3) patients were asked to relaxed, while the physiotherapist movements passive flexion in patients coupled with extra force, 5) The next patient is asked to return the knee extension position and then carried traction by pulling crus toward caudal, 6) the same procedure is repeated for the extension movement.

Measurements were performed before and after treatment in accordance HR and glucosamine treatment time of each group. ROM measurements made using a goniometer, using a visual analogue pain scale (VAS), muscle strength by manual muscle test (MMT), and COMP levels were measured by ELISA in Prodia laboratory, Makassar through serum decision on the subject.

This study was conducted over four months, January to April 2015. Analysis of the results of research performed using SPSS V.17 for Windows. Paired t-test and independent sample t-test is used for normally distributed data and Wilcoxon and Mann Whitney test for normally distributed data. This research has got Biomedical Research Ethics Approval Recommendation on Humans of the Faculty of Medicine, University of Hasanuddin No. 01 561 / H4.8.5.31 / PP36-KOMETIK / 2014.

3. Results

No statistically significant differences (P> 0.05) on the common characteristics and initial data the two groups before treatment is given HR and glucosamine (Table 1 and Table 2).

Table 2: General Characteristics and homogeneity subject pretest results Pain, Muscle Strength, ROM and sCOMP Research Subjects

Variable	Group 1				Group 2				P*
	Mean	SD	Min	Max	Mean	SD	Min	Max	
ROM	92.75	15.259	60	115	86.75	11.616	70	105	0.555
Pain	64.80	8.63	45	83	71.20	6.288	60	80	0.471
sCOMP	783.29	270.71	433.8	1442.9	833.97	231.32	433.8	1193.9	0.714
	Mode	Median	Min	Max	Mode	Median	Min	Min	P*
MMT	4	4	3	4	3	3	3	4	0.379

*Levene's test, p<0.05 declared meaningful (not homogeneous)

Results paired sample t-test and Wilcoxon test to changes in the intensity of pain (Table 3) indicate that there are significant differences in pain levels between before and after administration of the combination of physiotherapy HR and glucosamine, both in Group 1 (64.80 ± 8.63 to 42 , 25 ± 7.973) and in Group 2 (71.20 ± 6.288 be 27.75 ± 8.347). Decrease in pain in Group 2 (43.45 ± 9.395) was higher than Group 1 (22.55 ± 10.339).

Table 3: Changes in Pain Before and After Treatment

Group	Pretest		Posttest		Difference		t-paired test/Wilcoxon test
	Mean	SD	Mean	SD	Mean	SD	
1	64.80	8.63	42.25	7.973	22.55	10.339	P* = 0.000
2	71.20	6.288	27.75	8.347	43.45	9.395	P* = 0.000
t-independent sample test					P*** = 0.000		

* *t-paired sample test,* p < 0,05 significant

** Wilcoxon *test,* p < 0,05 significant

*** *t-independent sample test,* p < 0,05 significant

Table 4: Changes in Muscle Strength Before and After Treatment

HR Therapy Frequency	Observation	Muscle strength			Total
		3	4	5	
3x/week	Before	10 50%	10 50%	0 0%	20
	After	1 5%	13 65%	6 30%	20
	Total	11	23	6	40
6x/ week	Before	12 60%	8 40%	0 0%	20
	After	0 0%	1 5%	19 95%	20
	Total	12	9	19	40

Table 5: Changes in Muscle Strength Before and After Treatment

	Treatment group	
	Therapy 3x HR (group 1)	Therapy 6x HR (group 2)
Pearson Chi-Square	P* = 0.001	P* = 0.000

* Uji Pearson Chi-Square, p < 0,05 Significant

Chi-square test (Table 5) shows that there is a significant difference in muscle strength between before and after administration of the combination of physiotherapy HR and glucosamine, both in Group 1 and in Group 2. Increased muscle strength in group 1 was originally contained respectively 10 (50%) of people with muscle strength in categories 3 and 4, then after therapy HR, there were 13 (65%) of people in category 4, there were 6 (30%) of people in category 5, and the remaining 1 (5%) of people in category 3 . Whereas in group 2 showed an increase in muscle strength is better, where originally there were 12 (60%) of people with MMT in category 3 and 8 (40%) of category 4, then after therapy HR increased in category 5 were 19 (95%) of people and 1 (5%) of people in category 4 (Table 4). Differences increase muscle strength depicted in Figure 1.

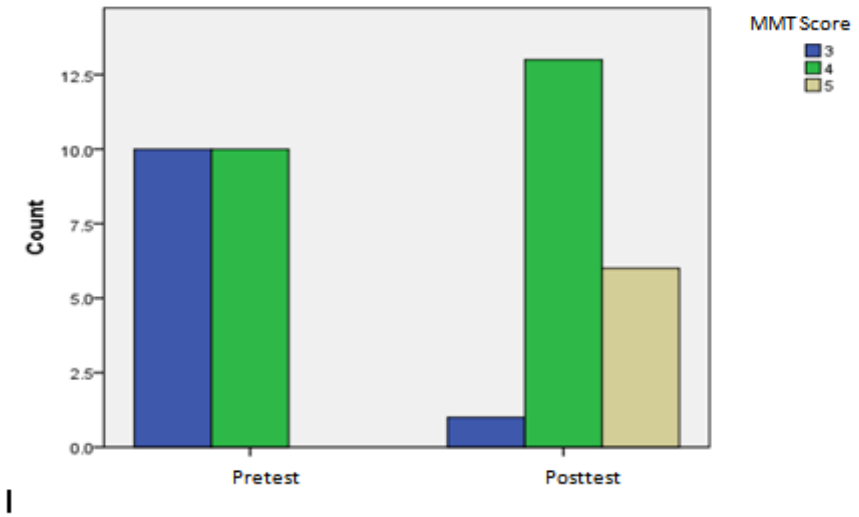

Figure 1: the different of Increase Muscle Strength

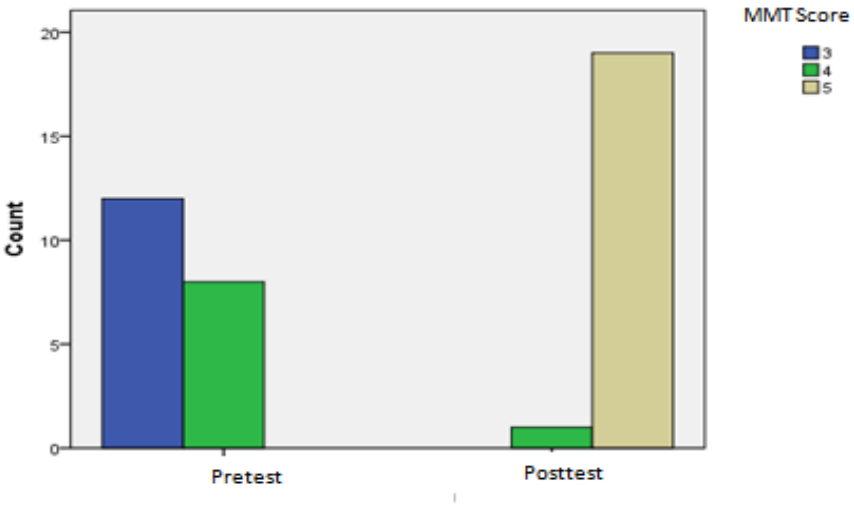

Figure 2: Improved Second MMT Treatment

Figure 1 and 2: Comparison of Improved Second MMT Treatment Group Wilcoxon test results showed that there are different levels of ROM meaningful change between before and after administration of the combination of physiotherapy HR and glucosamine, both in Group 1 (3 times treatment HR) and in Group 2 (6 times treatment HR).

Table 6: Test Results Wilcoxon and Mann Whitney Test against Amendment ROM

Group	Pretest		Posttest		Difference		Wilcoxon test
	Mean	SD	Mean	SD	Mean	SD	
1	92.75	15.259	115.25	13.81	22.50	6.387	P* = 0.000
2	86.75	11.616	136.00	3.839	49.25	10.295	P* = 0.000
Mann-Whitney test					P** = 0.000		

* Uji Wilcoxon, p < 0,05 Significant

** Uji Mann Whitney, p < 0,05 Significant

Table above shows an increase in ROM (mean ± SD) in Group 1 of 92.75 ± 15.259 be 115.25 ± 13.81, while in Group 2 of 86.75 ± 11,616 be 136.0 ± 3,839 as well as an increase in ROM in Group 2 (49.25 ± 10.295) was higher than Group 1 (22.5 ± 6.387) (Table 6).

Results paired sample t-test and Wilcoxon test showed that there were significant differences in levels sCOMP between before and after administration of the combination of physiotherapy HR and glucosamine, both in group 1 and group 2. Table 5.6 shows sCOMP decreased levels (mean ± SD) in group 1 of 783.29 ± 270.71 into 681.88 ± 287.27, while in Group 2 of 833.97 ± 231.32 into 639.63 ± 196.41 and decreased levels of sCOMP in Group 2 (194.34 ± 105.36) higher than Group 1 (101.42 ± 105.73 (Table 7)

Table 7: Levels of Change sCOMP

Group	Pretest		Posttest		Difference		Wilcoxon test/t-paired test
	Mean	SD	Mean	SD	Mean	SD	
1	783.29	270.71	681.63	287.27	101.42	105.73	P* = 0.002
2	833.97	231.32	639.63	196.41	194.34	105.36	P* = 0.000
t-independent sample test					P*** = 0.008		

* Wilcoxon test, p <0.05 Significant

** Paired sample t-test, p <0.05 Significant

*** Independent sample t-test, p <0.05 Significant

Results of Pearson correlation test between the ROM and pain (VAS), ROM with muscle strength, ROM with COMP, pain with muscle strength, pain with COMP, COMP and muscle strength with each obtained value of r

= -0.849 (p <0.001), r = 0.890 (p <0.01), r = -0.317 (p <0.05), r = -0.774 (p <0.01), and r = 0.213 (p <0.05), and r = -0.337 (p <0.01) (Table 8).

Table 8: Results Correlation ROM, Pain, MMT, and sCOMP Level

Correlation Test	VAS Score	MMT Score	sCOMP level
ROM (level)	P* = 0,000 r = –0,849	P** = 0,000 r = 0,890	P* = 0,002 r = –0,317
VAS Score	-	P** = 0,000 r = –0,774	P* = 0,029 r = 0,213
MMT Score	P** = 0,000 r = –0,774	-	P** = 0,001 r = –0,337

* P < 0,05, Uji Pearson correlation ; Significant

** P < 0,05, Uji Spearman laboratory: Significant

4. Discussion

Research conducted by [13] found that the provision of HR will be able to lessen the pain at the time of stretching the muscles and increase joint ROM actively or passively because when doing HR techniques using the theory of reciprocal innervation. The theory is the same meaning with the theory of reciprocal inhibition-fascilitation [14], [15], when HR is done in sequence that begins with active and passive movements toward agonist, then given stretching and resisted static contraction exercise on muscle, tendon hamstring and gastrocnemius , and the joint capsule that have contractures (component agonist), then simultaneously occur inhibition of sensory interneurons that led to the group quadriceps muscle, tendon and joint capsule and alfa interneuron leading to muscle groups quadriceps knee joint (antagonist) so that there will be a decrease in pain and relaxation the quadriceps muscle group (antagonist). Similarly, if done stretching exercise and resisted static contraction of the muscles and the quadriceps tendon and joint capsule that have contractures (group agonist), then simultaneously occur inhibition of sensory interneurons that led to the group hamstring muscles, tendons and joint capsule and alpha interneurons that leading to the hamstring and gastrocnemius muscle groups of the knee joint (antagonist), so there will be a decrease in pain and relaxation of the hamstring group and gastrocnemius muscle (antagonist).

Applications theory reciproke innervation is through the implementation of physiotherapy HR in OA of the knee joint describes and proves clearly that the technique HR effectively reduce pain through facilitation and inhibition, strengthens muscles via resisted static contraction, and stalling the muscles, tendons and capsules through stretching and traction joints, as well overcome joint stiffness, so that in the end the joint space and knee joint ROM increased, thereby inhibiting / stop the erosion of collagen, as well as address the inflammatory reaction in synovitis by flexing the synovial capsule, which in turn lowers COMP provable through exposure to

serum in the laboratory. Administration of glucosamine is intended to improve joint fluid, lubricants on both ends of the joints, and the joints nutrient source, thus reducing friction cartilage at the ends of the joints when doing HR.

In accordance with the findings in this study, the research conducted by Mikolajec [16] found an increase in muscle strength in athletes run after the exercise program with HR techniques. Implementation of engineering HR begins with static contraction of muscle against resistance (resisted static contraction) of the muscles antagonist shortened by the intensity of about 80 seconds (8 repetitions x 10 second) then interspersed with a relaxation of about 50 secon conducted alternately for the provision of HR in the OA will increase the number of mitochondria in the muscle, so that the size of the muscle to be larger that correlates with an increase in muscle strength in line with the sliding filament theory [17]. Thus, there will be an increase in muscle strength of both groups of flexor and extensor groups as well as increase the knee joint ROM. Movement is done as mentioned above, is known as reciproke innervation (Sherrington, 1968) and reciproke fascilitation and inhibition [18] that by Hindle and his colleagues [13] known as the movement cortical form of contraction-relaxation of the muscles optimally interspersed with relaxation, so thus, there will be an increase in the work function of the muscles preceded by a reduction in pain, muscle strengthening, and the addition of ROM.

In line with these results, the study conducted by Kondratek and his colleagues [19] who found that there is a significant increase in ROM HR technique thoracic when done regularly. These results are reinforced by Trent [20] and Fasen and his colleagues [21] on the selection of the amount of action and timing of the HR states that the increase in ROM of the ankle joint with the provision of PNF techniques HR conducted four times a week for 4 weeks is more effective to improve the ROM compared with only 2 times a week for 4 weeks. Hold Relax is a treatment technique that consists of: active facilitation, resisted, traction and passive useful in improving the ROM. Increased ROM in knee OA with HR technique, there are two ways, namely 1) the increase in active ROM, where at the end of the HR, the patient was told to do active movement towards the knee flexion (agonists), so m. Hamstring contracted actively and simultaneously m. Quadriceps (extensor muscle group) experience the relaxation (autonomic inhibition) [14,15]. Thus there will be the addition of ROM actively, 2) an increase in ROM passively, ie at the end HR after the patient's active movement towards flexion of the knee, then at the end position after the HR, the therapist encourages tibio fibular towards knee flexion passive (passive extra forced), so that the ROM has been established during the last active movement will be growing degree through passive motion [22]. This is reinforced by Hindle and his colleagues [13] which states that the reaction of contraction and relaxation is when given PNF techniques HR particularly passive at the end of the movement, there would be stretching the muscle fibers and when it ends with a movement of passive extra forced, then the muscle fibers that will be growing long, so there was the addition of the ROM of the knee joint, due to muscle stretching both active and passive according to the nature of flexibility and extensibility as the muscle contractile tissue.

Research Anderson and his colleagues [23] found that serum sCOMP increased in patients with knee OA compared to the control group after being given the physical exercise, the increase is temporary and will decrease again lower than the initial 30 minutes after the break. One of the causes of the increase is believed to be due to the movement sCOMP due to the imposition of cartilage and other tissues in the joints such as

synovitis, contractures synovial and swelling of the knee joint due to collagen degradation, among others, as when given HR, but it is temporary with a view to increasing ROM, addressing contracture synovial and the joint capsule, and strengthens muscles, when done HR to achieve such purposes, there will be an inflammatory reaction is explained by an increase in sCOMP temporary, as a sign of the beginning of the process of improvement of the structure and function of joints, especially if done repeatedly as in the provision of HR of this study [22], [24]. Another explanation is the modification of an extra-cartilage turnover cartilage degradation of cartilage in the form of sCOMP where sCOMP of the synovial fluid is transported to the lymphatic tissues and subsequently to the blood circulation system momentarily during physical exercise (30 minutes). Based on the results of this study, Anderson and his colleagues [23] suggested that sCOMP measurements performed after 30 minutes break to make it more accurate. Another study, by Neidhart and his colleagues [25], on the 8th marathon athletes find that after running a marathon, there is an increased sCOMP on the athlete than the control group. The increase was decreased after 24-48 hours of rest. The reasons underlying this study, the frequency of HR conducted research group within a day either 1 week or 2 weeks.

Osteoarthritis of the knee joint is a chronic degenerative condition that begins with cartilage degradation is characterized by increased sCOMP, painful motion as synovitis, muscle weakness, contractures capsules, muscles and tendons, causing the knee joint ROM limitations. HR when done repeatedly to extend the synovial tissue, so that the pain is reduced, and the stalling of muscle tissue / tendons have contractures, and increase muscle strength lead to the addition of joint space and ROM. This will reduce friction causes the cartilage during the move sCOMP decreased [22], [26]. This study found that there is a strong negative correlation (r = -0.849) between the ROM and pain, which increased the value of ROM, the decreasing level of pain experienced by patients and vice versa. It can be concluded that the addition of knee joint ROM in patients with OA will have implications for pain relief, because of the addition of ROM cause a reduction in contracture of the joint capsule, tendons and muscles, thus decreasing irritation nosciceptor on exertion. Similarly, a decrease irritation to the joint capsule. This causes increased pain decreased when the ROM. The strong correlation between the ROM and pain are also shown in Figure 3.

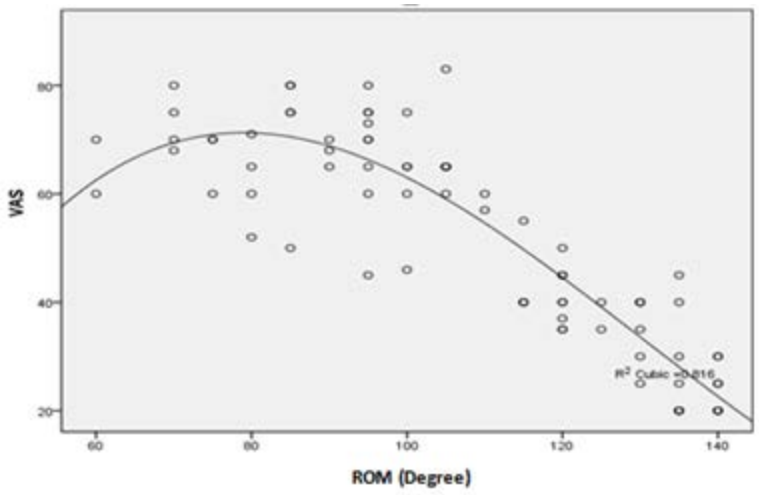

Figure 3: Correlation between ROM and Pain

Results Correlation between the ROM and muscle strength (MMT) indicated that there is a significant correlation with correlation coefficient r = 0.890 or 89%. This means there is a strong positive correlation between ROM with muscle strength, which increased the value of the ROM, then increasing the level of muscle strength experienced by patients and vice versa. It can be concluded that the addition of knee joint ROM in patients with OA will have implications on increasing muscle strength OA. It occurs because HR is able to increase the leverage ROM causes higher muscle exertion causes proliferation of the release of acetyl choline which gger the higher calcium involved in the sliding filament mechanism (decomposition ATP) resulted in increased action potential that encourage increased muscle contraction, thereby increasing muscle strength [17]. The correlation between the increase in ROM and increase muscle strength is also shown in the figure 3.

Results Correlation between ROM and sCOMP levels indicated that there is a significant correlation with correlation coefficient r = -0.317, or 31.7%. This means that there is a negative correlation between the levels sCOMP ROM, which increased the value of the ROM, then declining levels of sCOMP and vice versa. It can be concluded that the addition of the ROM of the knee joint in patients with OA will have implications for the decreased levels of sCOMP, because with increasing ROM, then the joint space is getting loose, the compression end joints decreases at the time of the move, so the erosion of collagen type 2 decreases, causing turnover COMP in joint synovial fluid decreases, so it is found in the serum COMP decreased.

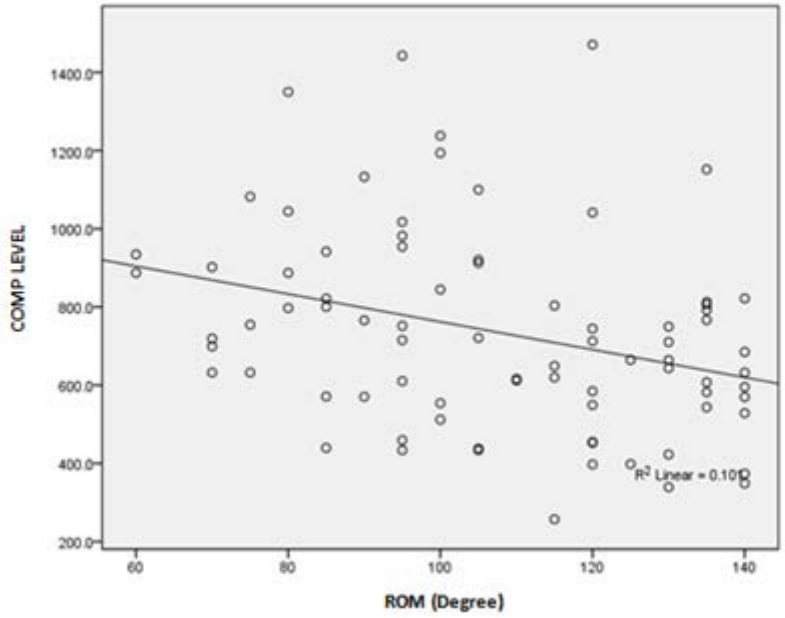

Figure 4: Correlation Between ROM and sCOM Level

Results Correlation between pain (VAS score) and the degree of muscle strength showed a significant correlation with correlation coefficient r = -0.774, or 77.4%. This means there is a strong negative correlation between the level of pain with muscle strength, which decreases the level of pain, the increased levels of

muscular strength and vice versa. It can be concluded that the reduction in knee joint pain in people with OA will have implications on increasing muscle strength OA patients for physiotherapy HR shown to reduce the intensity of pain in the muscles thus increasing the activation of the muscles that make the muscle is able to reach the maximum power of the current contract. In addition, when the muscle contracts, the blood circulation smoothly, more blood acid decomposes and is absorbed into the metabolic system [27].

Test results of Pearson correlation between pain (VAS score) and sCOMP levels showed a significant correlation with correlation coefficient r = 0.213 or 21.3%. This means that there is a positive correlation between pain levels sCOMP, where the decline in the level of pain, accompanied by decreased levels of sCOMP and vice versa. It can be concluded that the decreased levels of sCOMP OA would likely reduce joint pain knee OA patients, due to decreased levels of sCOMP is a marker for repairs collagen joints and decrease inflammation capsule synovial, which means irritation nosciceptor in synovial wane and the pain decreases, characterized by decrease sCOMP in the serum of patients with OA of the knee joint because HR is proven to reduce levels of COMP in the serum, through the mechanism of the addition of ROM, so that the joint space as wide, and reduce or eliminate contractures on the components of muscle, tendon, and the capsule synovial contractures, so that when the move, irritation of the synovial decreases, causing pain decreases as well, which is characterized by a decrease in blood serum levels of COMP. It can also be seen in Figure 5.

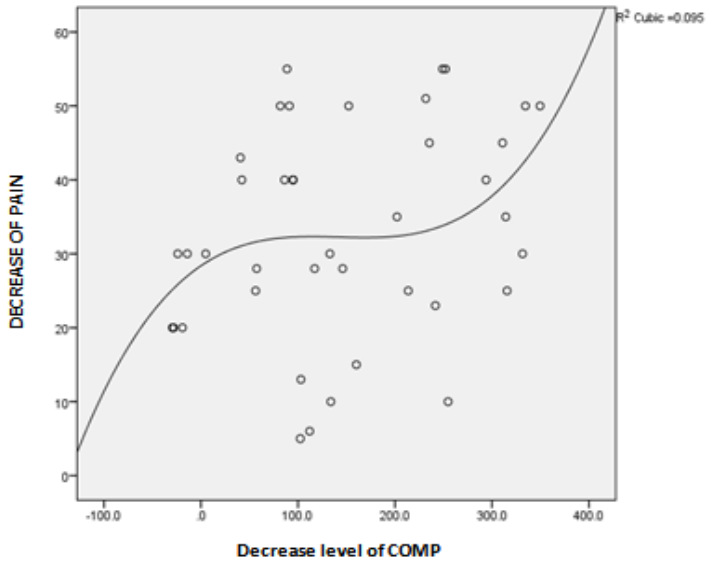

Figure 5: Correlation between decreased levels of pain and COMP Test Results.

The correlation between the degree of muscle strength and sCOMP levels showed a significant correlation with correlation coefficient r = -0.337 or 33.7. This means that there is a negative correlation between the degree of muscle strength with sCOMP levels. It can be concluded that the increase in muscle strength of the knee joint OA patients will affect sCOMP levels decrease in patients with OA because HR is proven to lower COMP. COMP decreased through an increase in knee joint ROM that causes the joint space is getting loose, the component contracture of muscles, tendons and synovial decreased so COMP decreases in serum accompanied by a decrease in the intensity of pain in the joints. Thus, the activation of muscle will increase when the contract

is capable of reaching maximum strength during muscle contraction. From the results of this study also found an increase sCOMP to 5 people research subject from Group 1. This is partly because of the five subjects the study had bilateral knee OA, KL IV and high activity related to their work. This is consistent with studies of Tseng and his colleagues [28] and Schiphof and his colleagues [29].

Based on these results, it is evident that the combination of physiotherapy HR and glucosamine can have a positive effect on improvement of disorders biomechanical form of pain relief static and pains of motion, increase muscle strength around the knee joint, reduction in contracture of the muscles, tendons and capsules, as well as the addition of ROM of the knee joint and space joint thereby reducing the friction between the ends of the joints and trigger biochemical improvement in the form of reduced levels of sCOMP as a sign of reduced degradation of collagen and decrease in synovial inflammation. Administration of glucosamine aims to reduce cartilage degradation as well as nutrients and lubricant for the joints so that at the end of the joint cartilage friction is reduced during the implementation of HR. There is a strong relationship between the addition of ROM with a decrease in pain and increase ROM with sCOMP decline, as well as the relationship is between sCOMP decline with a decrease in pain after administration of the combination of physiotherapy HR and glucosamine. All the above means that the provision of physiotherapy HR and glucosamine in patients with OA will encourage the improvement of patient activity which can ultimately improve their quality of life. Furthermore, if it can be pursued, with the provision of physiotherapy HR early (eg physiotherapy began in degrees TOS II and TOS III), predicted results will be better, so that patients more quickly contribute to the world of work each and will reduce the dependence of life to other people.

5. Conclusion

Based on this it can be concluded that the combination of physiotherapy HR and glucosamine in terms of number and time of treatment is effective in lowering levels of sCOMP through decreased pain, increased muscle strength, and the addition of knee joint ROM on osteoarhritis. In addition, the combination of physiotherapy HR and glucosamine 6 times in two weeks is more effective in lowering sCOMP through decreased pain, increased muscle strength, and additional ROM on osteoarhritis knee joints compared to the combination of the provision of physiotherapy HR and glucosamine 3 times in one week. The addition of OA of the knee joint ROM after the patient is given the combination of physiotherapy HR and glucosamine strong implications to decrease pain and sCOMP. Decreased levels sCOMP knee joint ROM due to the addition of OA patients after being given a combination of physiotherapy and glucosamine HR implications were to decrease pain.

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